

What is Claimed is:

1. In a communication system comprising at least a plurality of transmitting communication devices and a receiving communication device, a method of combining signals respectively transmitted from the transmitting communication devices to enhance reception at the receiving communication device, comprising:

- 5 (a) coordinating transmissions of the plurality of the transmitting communication devices such that a plurality of transmitted signals are respectively transmitted over the same communication channel by the plurality of transmitting communication devices substantially simultaneously, each of the transmitted signals including an information signal which is coherently combinable with corresponding information signals in others of the transmitted signals;
- (b) receiving the transmitted signals at the receiving communication device such that respective arrival times of the transmitted signals are offset from one another as a function of respective positions of the transmitting communication devices;
- (c) time aligning the transmitted signals to compensate for the respective arrival times of the transmitted signals;
- (d) combining the transmitted signals to form a combined signal including at least a combined information signal; and
- (e) detecting the combined signal to determine the presence of the transmitted signals.

2. The method of claim 1, wherein:

each of the transmitted signals further comprises an acquisition signal;

(b) includes correlating the acquisition signal of transmitted signals received by the receiving communication device to a stored signal to estimate the arrival times of the transmitted signals; and

(d) includes combining information signals from at least some of the transmitted signals correlated in (b) to form the combined information signal.

3. The method of claim 2, wherein the acquisition signal in each of the transmitted signals is identical.

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4. The method of claim 1, wherein (c) includes phase rotating at least some of the transmitted signals correlated in (b) to adjust a relative timing of the transmitted signals to account for timing offsets among the respective arrival times of the transmitted signals.

5. The method of claim 1, wherein the transmitted signals arrive at the receiving communication device within an acquisition time interval having a duration sufficiently short to permit combining of the transmitted signals.

6. The method of claim 1, wherein the information signal in each of the transmitted signals is identical.

7. The method of claim 1, wherein each of the transmitted signals includes a serial probe comprising a known data sequence, the method further comprising:

(f) determining a channel impulse response from the serial probe.

8. The method of claim 1, wherein the transmitted signals are heuristic combined by phase matching and adding the magnitude of the transmitted signals.

9. The method of claim 1, wherein the transmitted signals are combined using an equalizer.

10. The method of claim 1, wherein at least one of the transmitting communication devices is a mobile communication device

11. The method of claim 1, wherein the receiving communication device is a mobile communication device.

12. In a communication system comprising at least a plurality of transmitting communication devices and a receiving communication device, a method of coordinating transmission of signals respectively transmitted from the transmitting communication devices to the receiving device, comprising:

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5 (a) establishing a common time reference among the transmitting communication devices;

(b) commanding the transmitting communication devices to transmit signals to the receiving device at a future time; and

10 (c) respectively transmitting a plurality of signals from the transmitting communication devices at the future time, such that the plurality of signals are respectively transmitted over the same communication channel substantially simultaneously, each of the signals including an information signal which is coherently combinable with corresponding information signals in others of the signals.

13. The method of claim 12, wherein one of the transmitting communication devices commands others of the transmitting communication devices to transmit signals at the future time.

14. The method of claim 13, wherein said one of the transmitting communication devices broadcasts a command to said others of the transmitting communication devices.

15. The method of claim 12, wherein a time between commanding of the transmitting communication devices and the future time is greater than a longest signal propagation time between transmitting communication devices

16. The method of claim 12, wherein at least one of the transmitting communication devices is a mobile communication device.

17. The method of claim 12, wherein the receiving communication device is a mobile communication device.

18. The method of claim 12, wherein the common time reference is the time of day.

19. A method of detecting a plurality of signals respectively transmitted substantially simultaneously from a plurality of transmitting communication devices over the same communication channel, comprising:

(a) receiving the transmitted signals at a receiving communication device such that  
 5 respective arrival times of the transmitted signals are offset from one another as a function of  
 respective positions of the transmitting communication devices, each of the transmitted  
 signals including an information signal which is coherently combinable with corresponding  
 information signals in others of the transmitted signals;

(b) time aligning the transmitted signals to compensate for the respective arrival times  
 10 of the transmitted signals;

(c) combining the transmitted signals to form a combined signal including at least a  
 combined information signal; and

(d) detecting the combined signal to determine the presence of the transmitted signals

20. The method of claim 19, wherein:

each of the transmitted signals further comprises an acquisition signal;

(a) includes correlating the acquisition signal of transmitted signals received by the  
 receiving communication device to a stored signal to estimate the arrival times of the  
 transmitted signals; and

(c) includes combining information signals from at least some of the transmitted  
 signals correlated in (a) to form the combined information signal.

21. The method of claim 19, wherein (b) includes phase rotating at least some of the  
 transmitted signals correlated in (a) to adjust a relative timing of the transmitted signals to  
 account for timing offsets among the respective arrival times of the transmitted signals.

22. The method of claim 19, wherein at least one of the transmitting communication  
 devices is a mobile communication device.

23. The method of claim 19, wherein the receiving communication device is a mobile  
 communication device.

24. A communication system, comprising:

a plurality of transmitting communication devices configured to respectively transmit  
 a plurality of transmitted signals over the same communication channel substantially

simultaneously, each of the transmitted signals including an information signal which is coherently combinable with corresponding information signals in others of the transmitted signals; and

a receiving communication device configured to receive the transmitted signals at respective arrival times which are offset from one another as a function of respective positions of the transmitting communication devices, said receiving communication device time aligning the transmitted signals to compensate for the respective arrival times and combining the transmitted signals to form a combined signal.

25. The system of claim 24, wherein each of the transmitted signals further comprises an acquisition signal and said receiving communication device comprises:

a correlator configured to correlate the acquisition signal of transmitted signals to a stored signal to estimate the respective arrival times of the transmitted signals;

a phase rotator configured to phase rotate at least some of the transmitted signals to adjust a relative timing of the transmitted signals to account for timing offsets among the respective arrival times of the transmitted signals; and

a signal combiner configured to combine the transmitted signals to form the combined signal.

26. The system of claim 25, wherein the information signal in each of the transmitted signals is identical, and the combined signal includes at least a combined information signal, the receiving communication device further comprising a signal detector configured to detect the combined signal and determine the information contained in the combined information signal.

27. The system of claim 24, wherein the receiving communication device further comprises:

a digital matched filter configured to generate a matched filter signal based on the transmitted signals received by the receiving communication device.

28. The system of claim 24, wherein the receiving communication device further comprises:

a plurality of tapped delay lines configured to modify the phase and amplitude of the transmitted signals.

29. The system of claim 24, wherein each of the transmitted signals includes a serial probe comprising a known data sequence, and wherein the receiving communication device determines a channel impulse response from the serial probe.

30. The system of claim 24, wherein said receiving communication device heuristically combines the transmitted signals by phase matching and adding the magnitude of the transmitted signals.

31. The system of claim 24, wherein said receiving communication device comprises an equalizer.

32. The system of claim 24, wherein at least one of the transmitting communication devices is a mobile communication device.

33. The system of claim 24, wherein the receiving communication device is a mobile communication device.

34. A communication device for detecting a plurality of signals respectively transmitted substantially simultaneously from a plurality of transmitting communication devices over the same communication channel, the communication device comprising:

a digital matched filter configured to generate a matched filter signal in response to reception of the transmitted signals at the communication device, wherein respective arrival times of the transmitted signals are offset from one another as a function of respective positions of the transmitting communication devices;

a plurality of tapped delay lines each configured to adjust a phase and frequency of the matched filter signal in accordance with weighting coefficients;

a correlator configured to generate a correlation signal indicative of an amount of correlation among outputs of the plurality of tapped delay lines;

a peak detector configured to detect peaks of the correlation signal;

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a phase rotator configured to rotate the phase of detected peaks of the correlation signal to account for timing offsets among the respective arrival times of the transmitted signals;

a combiner configured to coherently combine the detected peaks to form a combined signal, thereby time aligning the transmitted signals to compensate for the respective arrival times of the transmitted signals; and

a detector configured to detect a presence of the transmitted signals from the combined signal.

35. The communication device of claim 34, wherein in the plurality of tapped delay lines operates as an equalizer.

36. The communication device of claim 34, wherein each of the transmitted signals includes a serial probe comprising a known data sequence, and wherein said communication device determines a channel impulse response from the serial probe and determines the weighting coefficients from the channel impulse response.

37. The communication device of claim 34, said communication device heuristically combines the transmitted signals by phase matching and adding the magnitude of the transmitted signals.

38. The communication device of claim 34, wherein the communication device is a mobile communication device.

39. A communication device for detecting a plurality of signals respectively transmitted substantially simultaneously from a plurality of transmitting communication devices over the same communication channel, comprising:

means for receiving the transmitted signals such that respective arrival times of the transmitted signals are offset from one another as a function of respective positions of the transmitting communication devices, each of the transmitted signals including an information signal which is coherently combinable with corresponding information signals in others of the transmitted signals;

means for time aligning the transmitted signals to compensate for the respective  
10 arrival times of the transmitted signals;

means for combining the transmitted signals to form a combined signal including at  
least a combined information signal; and

means for detecting the combined signal to determine the presence of the transmitted  
signals.

40. The communication device of claim 39, wherein each of the transmitted signals  
further comprises an acquisition signal, the communication device further comprising:

means for correlating the acquisition signal of transmitted signals received by the  
communication device to a stored signal to estimate the arrival times of the transmitted  
signals.

41. The communication device of claim 39, wherein said means for time aligning  
includes means for rotating a phase at least some of the transmitted signals to adjust a relative  
timing of the transmitted signals to account for timing offsets among the respective arrival  
times of the transmitted signals.

42. The communication device of claim 39, wherein the communication device is a  
mobile communication device.

43. A network of communication devices, comprising:

a lead communication device and a plurality of other communication devices sharing  
a common time reference with the lead communication device, wherein the lead  
communication device commands the plurality of other communication devices to transmit  
5 signals to a receiving device at a future time, and wherein the lead communication device and  
the plurality of other communication devices respectively transmit a plurality of signals at the  
future time, such that the plurality of signals are respectively transmitted over the same  
communication channel substantially simultaneously, each of the plurality of signals  
including an information signal which is coherently combinable with corresponding  
10 information signals in others of the signals.



44. The network of claim 43, wherein the lead communication device broadcasts a command to the plurality of other communication devices.

45. The network of claim 43, wherein a time between commanding of the plurality of other communication devices and the future time is greater than a longest signal propagation time between the lead communication device and the other communication devices

46. The network of claim 43, wherein the common time reference is the time of day.

47. The network of claim 43, wherein the lead communication device is a mobile communication device.

48. The network of claim 43, wherein at least one of the plurality of other communication devices is a mobile communication device.

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